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Smartphone-Enabled Chemical Analysis for Environmental Monitoring In Resource-Poor and Remote Areas

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Extended Abstract

Contemporary chemical analysis is based on sophisticated and expensive instruments that are out of reach for communities living in resource-poor and remote areas. Water contamination with heavy metals and organic compounds is usually a local environmental problem that in many cases is not promptly addressed by environmental agencies, putting underrepresented communities at health risks. A famous example is the Flint City in the USA, where citizens were exposed to lead by drinking a contaminated water [1].

The objective of this work is to demonstrate a new smartphone-enabled method for the quantification of copper ions in water. The method is based on the measurements of turbidity changes of water in the presence of dithiooxamide (dto), a copper precipitating chemical agent. A sample of water, is mixed with the dto in a 3D printed sample compartment, and placed on the custom-designed optical platform. The images of water samples are captured by a smartphone camera and analyzed by an image-processing algorithm which enables the transformation of the image data from RGB to HSV colour space and calculation of a mean value of the light-intensity component (V value) [2]. The method can be used to detect copper (II) ions within 2-15 mg/L concentration range. The advantage of the method is a low cost, and its integration with a smartphone offers a possibility to quantify copper and other metal ions on demand, in remote areas where the access to analytical instruments is limited. The authors aim is to educate youth in chemistry and environmental protection fields about alternative methods for in-situ monitoring of their environment and health.

In conjunction the Japan Science and Technology-sponsored project in Africa [3], we are now preparing related educational materials for the use in schools located in the vicinity of copper mining areas. We hope that our educational efforts will bring good health and improve well-being for people in resource-poor and remote areas.

References

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